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AUTHOR Beijaard, D.
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ABSTRACT

Eleven training centers for practical agricultural education in the Netherlands provide practical courses for all levels of students or trainees. A sample of 29 experienced instructors was selected at random from the centers to participate in the research project designed to identify the didactical qualities of the instructors and to develop an inservice training program based on the results. Data collection involved interviews, observations of practical lessons, retrospective techniques, and log books. Discussed are several characteristics of practical teaching of the instructors, including subjectivity and intentionality, reflexivity, relation to the context, and limitation. Special attention is paid to aspects of the instructors' task environment, its influence on teaching, and issues regarding the teaching process itself. The quality of instructors' reflections on their own teaching process has implications for a didactical inservice training program that would enable instructors to improve their teaching capabilities. (Author/MT)

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RESEARCH ON AND DEVELOPMENT OF TEACHING BY INSTRUCTORS IN THE DUTCH TRAINING CENTRES FOR PRACTICAL AGRICULTURAL EDUCATION

Paper presented at the ICET Thirty-Fourth World Assembly

Eindhoven, July 1987

D. Beijaard
Agricultural University
Department of Education and
Teacher Training
Hollandseweg 1
6706 KN Wageningen
The Netherlands

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ABSTRACT

The eleven training centres for practical agricultural education in The Netherlands provide practical courses for all kinds of students or trainees. This paper describes several characteristics of practical teaching by the instructors of these courses. As a result of this research project, special attention is paid to aspects of the instructors' task environment, its influence on teaching, and issues regarding the teaching process itself. Particularly the quality of instructors' reflections upon their own teaching process implies a number of possible suggestions for a didactical in-service training programme, enabling them to improve their teaching capabilities.

INTRODUCTION

In The Netherlands are eleven practical training centres for agricultural education. These centres habe been founded around 1960 and may be characterised at this time as complex institutions, representing one or more agricultural disciplines. They provide practical educational programmes for pupils and students from regular lower-, secondary- and higher agricultural schools, and students from the Agricultural University of Wageningen and the Veterinary Faculty of Utrecht State University. Furthermore, they offer training programmes to teachers, employees from trade and industry and trainees from foreign, mostly Third World countries. Some training centres also support or participate in development projects in the field of agricultural education.

The establishment of practical training centres has been based on a well-intentioned agricultural educational policy. Concentrating sophisticated and up-to-date equipment in the practical training centres allows the regular agricultural schools to meet practical training by only a standard set. As a consequence of this policy, the training centres do substantially contribute to agricultural innovations. Moreover, it guarantees that rather expensive equipment is indeed frequently made use of as learning materials.

The training centres train students in executing practical agricultural activities. They are instructed by experts according

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to the basic principle of 'learning by doing'. In general instructors, who have different tasks and functions in the internal and external organization of the centres, are highly qualified and they have substantional experience in their fields. Most of them, however, did not receive adequate teacher training. They have to master this side of their profession by observing lessons and talking with colleagues during their first months at the training centre. For this reason, didactical in-service training is in great demand (Beijaard, 1985).

This paper describes the results of a three-year research project concerning the didactical qualities of the instructors and their programmes, and the development of an in-service training programme based on the results of the research.

PROJECT OVERVIEW AND SCOPE OF THIS PAPER

The project started in August 1984 and has ended in July 1987. Figure 1 shows that the project had several phases with the emphasis on research.

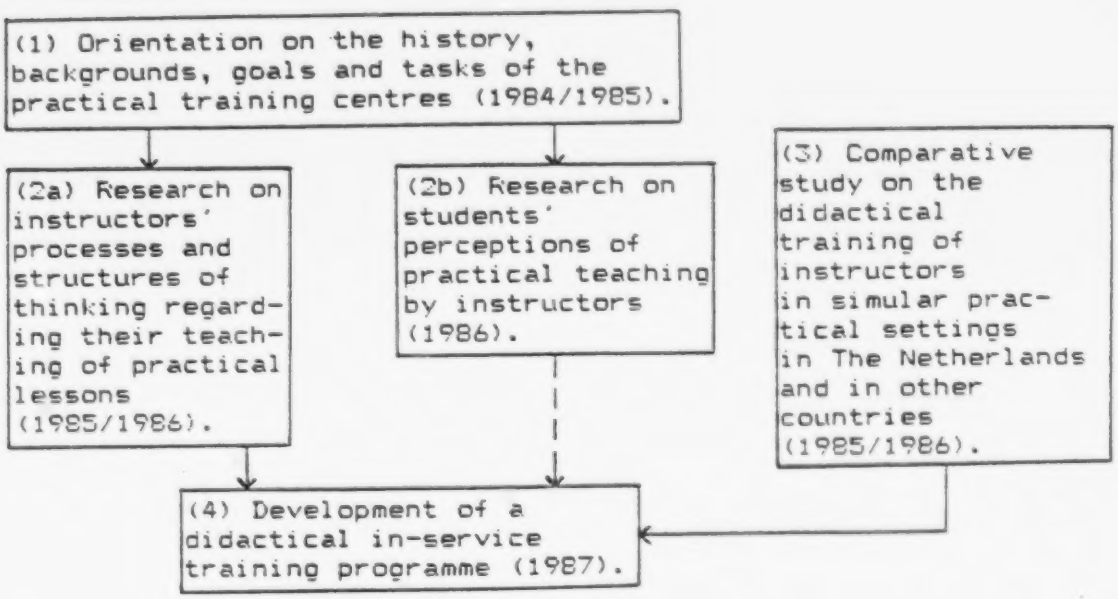

(1) Orientation on the history, backgrounds, goals and tasks of the practical training centres (1984/1985).
(2a) Research on instructors' processes and structures of thinking regarding their teaching of practical lessons (1985/1986).
(2b) Research on students' perceptions of practical teaching by instructors (1986).
(3) Comparative study on the didactical training of instructors in simular practical settings in The Netherlands and in other countries (1985/1986).
(4) Development of a didactical in-service training programme (1987).

Figure 1: Project activities and their relations

Most of the research, about 1½ year, has been devoted to the instructors' processes and structures of thinking (phase 2a in figure 1). This part of the project was also the most important source for the development of an in-service training programme. For these reasons this paper will be limited to this project phase.

RESEARCH DESIGN AND METHODOLOGICAL CONSIDERATIONS

Action oriented approach

The process of practical teaching has been studied by approaching behaviour, underlying cognitive processes and structures, and aspects of the task environment in an integrative way. In fact, this is an action oriented approach with the emphasis on instructors' subjective theories. This approach tries to bridge the gap between cognition and behaviour within educational research on the one hand, and between didactical theory and practice on the other. Research based on an action oriented approach enables a better understanding of teaching as a complex activity and it does more justice to reality interpretations of (individual) persons than research based on other, e.g. the behaviouristic paradigm. There is a strong relationship between what is in the mind and what can be seen by observation, and both of these are studied as parts of one action within a natural environment.

Detailed characteristics of the action oriented approach in question are the following (Nijk, 1984; Beijaard, 1986):

- subjectivity and intentionality: activities are attributed to persons. Teaching is - though not always directly visible - an intentional activity;
- reflexivity: persons are cognitively related to their activities, which enables them to verbalize these activities. This makes it possible to speak about teaching in terms of actions. Because of several reasons, however, cognitive representations are not always necessarily adequate;
- relation to the context: actions are always the result of interaction with the environment, but, at the same time, they mould this environment;
- limitation: possibilities to act are limited by conditions from the task environment, one's own knowledge of what one is doing, and one's flexibility within a given action repertory. Flexibility also determines the quality of an action.

By applying these four characteristics in research, it is possible - as a result of this research - to develop an in-service training programme which is connected with the instructors' daily teaching activities and their reflections upon these (cf. Floden, 1985). In this way an exchange can be realised between 'objective' or scientifically gained knowledge on the one hand, and 'subjective' theory or knowledge of (individual) instructors on the other.

In addition, teaching is defined as an action unit consisting of the planning and execution of lessons and the reflection on these two. Reflection, apart from being a component of teaching, has also been introduced as a key-concept to determine the quality of the instructors' subjective theories. Reflection in this sense is a function of the intentionality or a function of subjective theories.

Model of teaching

The study of developments in didactional theory has been helpful to construct an heuristic model for the research on teaching.

Figure 2 presents the structure of this model. Actually, the model has a systemic and cyclic nature (cf. Van Bergeijk, 1982). The three sub-systems are strongly interrelated.

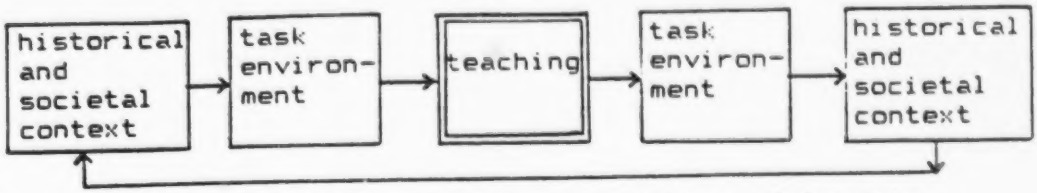


Figure 2: Interrelation between sub-systems of teaching

As the result of the orientational study (phase 1 in figure 1), aspects of the historical and societal context have already been described in an earlier stage (Beijaard, 1985). This paper describes research results regarding the other two sub-systems and the way in which they are interrelated. The specification of these two sub-systems resulted into many points of attention for research. For the task environment these concerned backgrounds and personal characteristics of the instructors, the equipment, trainees or students, curricula, and the internal organization of the training centres. The points of attention for teaching as a sub-system concerned: the goals and contents or subjects of the practical lessons, the teaching methodology, the teaching and learning aids used, and the interaction between the instructors and students or trainees. These aspects were, especially, regarding the execution of lessons. Attention was also paid to the teaching components planning and reflection.

Collection and analysis of data

A total of 29 experienced instructors, equally spread over the eleven training centres and the courses these centres offer, participated in the research. All of them were selected at random and no one refused to co-operate. It may be assumed that this co-operation was due to the correspondence with the participants, their satisfaction with the results of the orientational study (phase 1 in figure 1), and to the internal educational co-ordinators in each training centre who played an important intermediary role.

Data collection was realised by using a combined set of methods, namely: interviews, observations of practical lessons, retrospective techniques with reference to the observed lessons, and log-book reporting. Most of the collected data were stored by using a tape recorder. The procedures of data collection lasted about one day per participant. Together, the methods led to an extensive inventory of instructors' (implicit and tacit) subjective theories in terms of thoughts, beliefs, intentions, etc. (cf. Shavelson & Stern, 1981; Olson, 1984).

The analysis and interpretation of the data consisted of three steps as is illustrated in figure 3. The nature of the data analysis has been qualitative and took place according to systematic procedures (cf. Miles & Huberman, 1984).

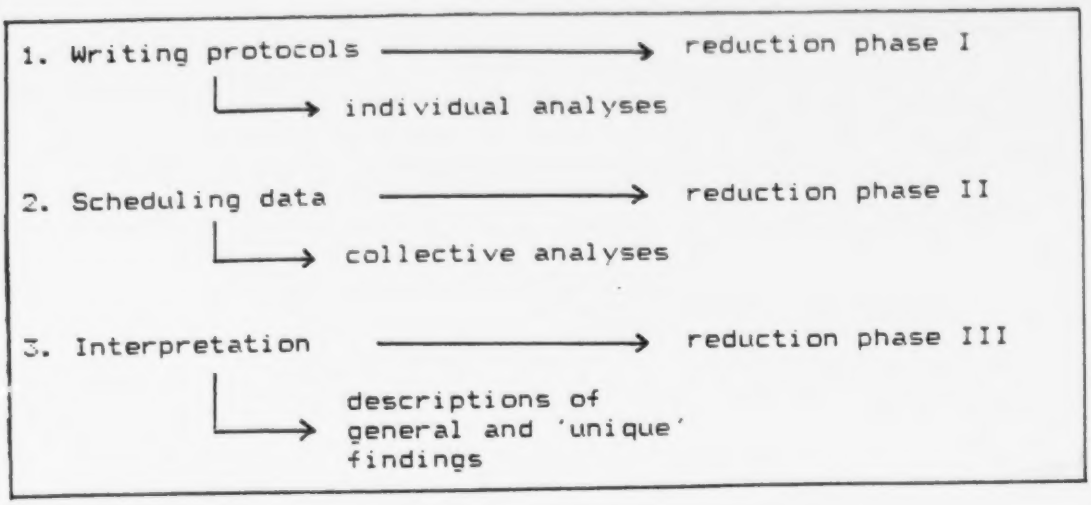


Figure 3: Analysis and reduction of data

Reliability and validity of research results

In the naturalistic research in question reliability has been realised by explicating theoretical insights, selection procedures, and aspects regarding the methodological and technical methods used. The reliability has been increased by tape recording the data, illustrating conclusions with concrete pronouncements of the instructors involved, and using more than one method (method triangulation) and, thereby, more than one data source too (data triangulation). Particularly, the production of complete 'pictures', based on different data sources, did not always appear to be easy (Beijaard, 1986).

Validity of the results has been pursued by way of a try-out, which made disturbing effects visible, and also appeared to be a good exercise for the researcher. Moreover, the participants were explicitly questioned after disturbing influences as a part of the data collection. They only experienced the log-book reporting as a time-consuming activity.

Particularly, the collection of ecological valide data was of great importance. For this reason the instructors involved were expressly requested to act as usual. Most of the instructors confirmed that they acted in conformity with their teaching reality. Though carefully selected, the number of participants involved limits the generalization of the results.

Finally, while collecting the data, verbalizations were validated by observations (action validation) and, on their turn, these observations were validated again by verbalizations with reference to retrospective 'context-embedded' questions (communicative validation). Sometimes instructors were not able to react adequately on these questions or reacted a little surprised when confronted with questions about their own teaching. Especially the more experienced instructors showed much consistency between what they were doing and what they were saying (Beijaard, 1986).

RESEARCH RESULTS

Something about the task environment and its influence on teaching

In the training centres the learning of practical agricultural skills primarily depends on the available equipment. In small groups, varying from six to eight, students or trainees practice skills regarding the repairs and maintenance of implements, the use of these implements (in the field), cattle and plant breeding, crop protection, forestry, land development, horse riding, pig and poultry husbandry, and milling business. Related to these agricultural disciplines students or trainees learn manual, planning, co-ordinating and entrepeneur skills.

Based on the equipment three kinds of practical training can be distinguished:

- training by simulation and reduction of the (complex) reality (e.g. with the help of models and parts of machinery);
- training in the reality itself (e.g. using machines and implements in the centres' own farms and in the fields);
- training in situations which approach reality as close as possible (e.g. tractor driving and ploughing in huge sheds or working halls, especially in bad weather).

In support of these kinds of training, instructors often use many different written materials and audio-visual learning aids. The instructor's choice of the learning aids, including e.g. implements and animals, depends on its actuality and the degree in which it is made use of in the agricultural branch of industry, the objective and content of the lesson, and the previous training of the students or trainees. Moreover, the available learning aids strongly determine whether students or trainees practice individually, in pairs or in small groups. In general it is pursued that they practice actively and intensively. Mostly co-operation also leads to satisfying results.

The authorities prescribe that the training centres have to give priority to students from regular (secondary) agricultural schools. Still there are many other target groups to teach (see figure 4). Instructors experience strong differences between attitudes of students or trainees to practical training. Students from higher agricultural schools, e.g, want to discuss with them and need to be encouraged to practice, while students from secondary agricultural schools can hardly wait to do their practices. Other students, e.g. trainees from industry, are interested only in practical training which they see as important for their own affairs, etc. Moreover, they differ in their previous training and in agricultural backgrounds, which thwartens the formation of coherent learning groups.

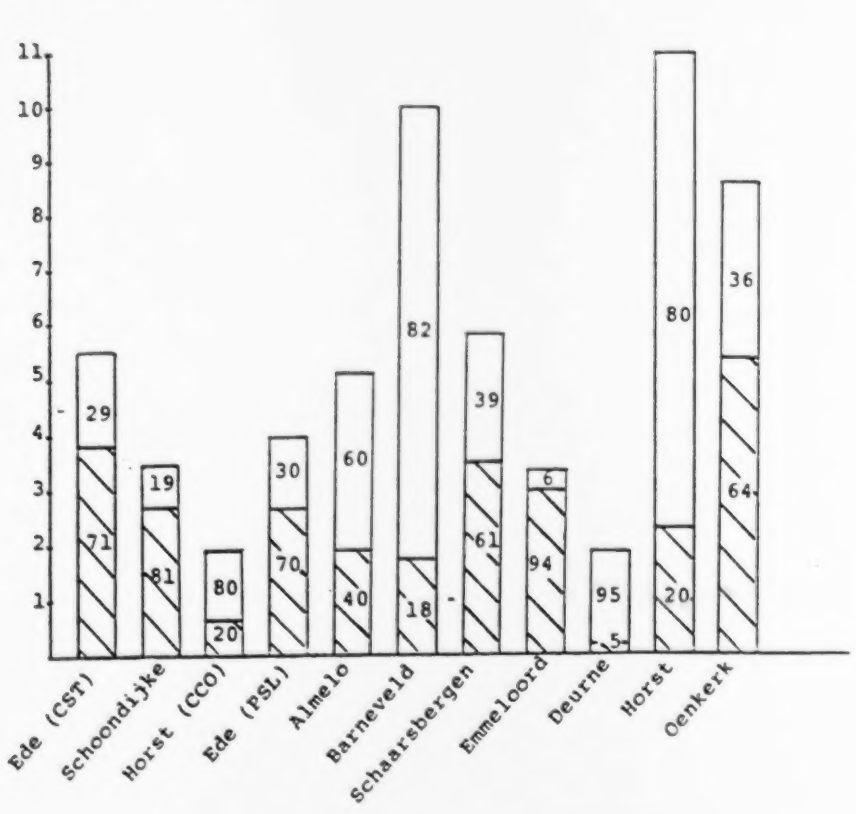
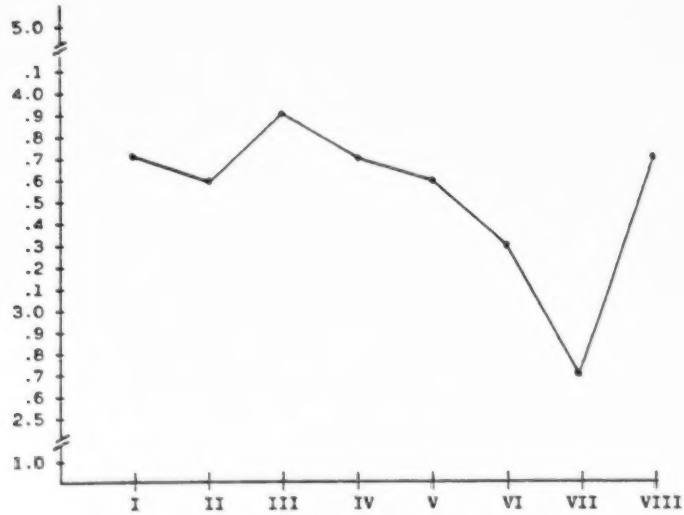


Figure 4: Percentage origin and number of participants in the school-year 1984/1985 (Beijaard, 1985)

Research on students' perceptions (phase 2b in figure 1) resulted in conclusions regarding (Kingma, 1986):

- the teaching and learning process: instructors explain clearly, give the opportunity to ask questions, are friendly, and create a pleasant training atmosphere;
- the effects of practical training: a visit to a practical training centre enables one to learn a lot, and being taught in small groups is advantageous;

Especially students from regular agricultural schools experience practical courses in the training centres as essential within their education. Figure 5 summarizes their perceptions of aspects regarding their visits to the practical training centres.



(I = motivation and practicing; II = instruction and supervision; III = climate and atmosphere while practicing; IV = learning effects; V = general opinion about their visits; VI = stay in the boarding-houses; VII = actual connection between the regular schools and the training centres; VIII = desired connection between the regular schools and the training centres).

Figure 5: Average scores of students' perceptions (n =400)

According to students, there exist a great discrepancy between the curricula of their own schools and those of the practical training centres. This discrepancy is also recognized by the instructors at the beginning of their lessons. For this reason they have to possess flexible and improvising teaching qualities. They also have to be qualified and experienced in their fields of specialization. Nevertheless, co-operation between regular schools and the training centres should be improved. Both types of education supplement each other with a view on students' (future) professions (see figure 6).

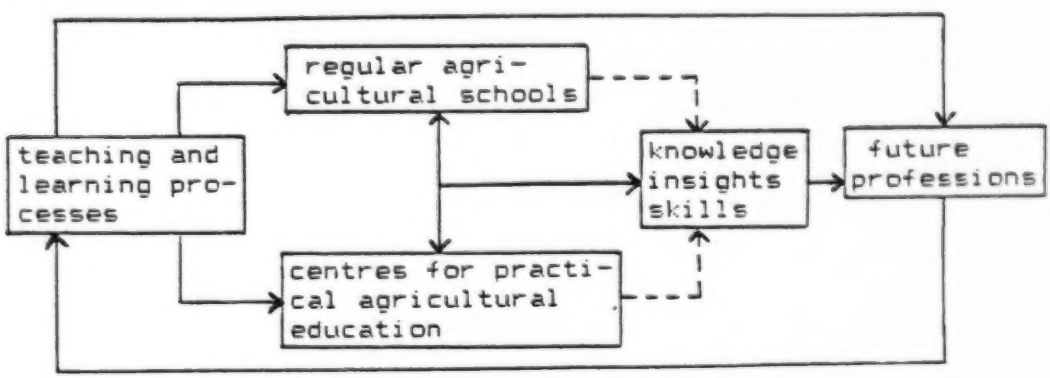


Figure 6: Shared responsibility of regular schools and practical training centres

In support of practical lessons, instructors make use of many different kinds of written materials. They function as references, guarantee uniformity in knowledge transmission, and enable students or trainees to prepare themselves in advance for their visit to a practical training centre. Mostly, however, instructional leaflets are used which partly replace the instructor. These leaflets encourage students or trainees to pratice independently, though supervised by the instructor.

Many instructors act according to so-called instructor instructions. The use of these instructions, which can be compared with lesson schemes, is particularly important for novices. The instructions also guarantee uniformity in knowledge transmission, benefit safety aspects, and take care of a responsible use of implements and animals. The main disadvantage of instructor instructions is the tendency to reduce teaching to the mere execution of lessons, mostly prescribed by others. Usually there is little room for educational experimenting. Some instructors experience this as an obstruction to their teaching satisfaction, while, on the other hand, others appreciate instructor instructions as important teaching guides.

Beginning instructors learn their teaching task by observing lessons of colleagues, gradually starting to teach under supervision, and to teach independently (rather simple lessons at first and more complicated lessons afterwards). Within the organizational structure of the training centres, however, there usually is not much time for novices to get thoroughly acquainted with many aspects of teaching and subjects.

Particularly in training centres, which represent several agricultural disciplines and offer many courses to different types of students or trainees simultaneously, it often is difficult to plan the available equipment and rooms to practice. In many centres this is a full-time co-ordinating job.

Although important in connection with the innovative function of the training centres, there hardly are facilities enabling instructors to participate in in-service training courses regarding agricultural developments. In most cases, they read about these in professional journals and sometimes there is a possibility to visit an exhibition.

The action unit: planning, execution and reflection

Instructors differ from one another in their individual needs for lesson planning. Based on experience, they tend to reduce their lesson planning to organizational matters when they regularly teach the same lessons to the same types of students or trainees, when they master the lesson subject, and when the lesson has a fixed structure or is a part of a standardized programme. It may, however, not be concluded that many lessons remain the same for a long-time. On the contrary, agricultural developments regularly lead to lesson changes.

According to instructors, the following points of attention are - generally and in order of frequency - important for their lesson planning:

- checking the equipment and learning aids on their functioning and availability;
- determining the lesson content;
- orientation on the previous training and backgrounds of students or trainees;
- formulating lesson goals whether or not in terms of what students or trainees have to know or must be able to do.

Instructors, who are used to plan their lessons extensively, seldom plan from formulated lesson goals or previous training and backgrounds of students or trainees. Possibly they handle aspects of these planning components routinely, though they are continuously confronted with changing target groups whose previous training and backgrounds often differ strongly. This indicates that the planning aspects in question just become important during the lesson itself, causing lesson planning to be a certain ad hoc activity.

During the research, practical lessons have been observed for the duration of 50, 100 and 200 minutes, but also lessons of one whole day occur. Figure 7 illustrates the phases of the most observed lessons.

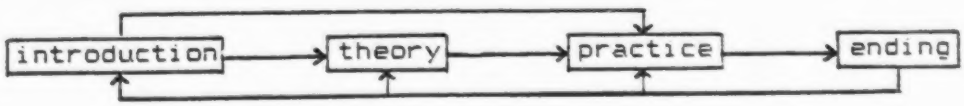


Figure 7: Phases of practical lessons

Most instructors start their lessons with making acquaintance if they have to train a new group. According to many instructors this determines the atmosphere of the whole lesson. Moreover, during the introduction instructors:

- estimate the previous knowledge, experience and interest of students or trainees by questioning, which determines the usage of instructional techniques during the rest of a lesson;
- tell something about the lesson goals, what can be expected, and the available time. Instructors suppose that clarity encourages the motivation and involvement of students or trainees.

In general the introduction relatively takes little time.

After the introduction, some instructors immediately start with the practical lesson phase (see figure 7), but usually this phase is preceded by a theoretical part consisting of information or knowledge transmission. However, many instructors prefer to speak of 'instruction' in this phase. According to them 'instruction' better covers the skills to be trained in terms of 'what' and 'how'. Moreover, 'instruction' is closely related to demonstrating one or more actions by the instructor, while information or knowledge transmission has a nature of 'speaking about', possibly supported by audio-visual learning aids, parts of machinery or materials. During practical lessons instruction and information or knowledge transmission often take place successively or are integrated.

Safety aspects and the error-tolerance determine whether students or trainees practice fully independently or not. Practicing independently, as instructors say, increases the involvement, encourages thinking, and corresponds to the reality.

At the end of a lesson in most cases a short review or evaluation takes place. In this phase instructors check the learning results, repeat or summarize the most important lesson features, correct made mistakes, etc. Moreover, students or trainees often get the opportunity to judge their own and each other's work. Many of the instructor activities at the end of a lesson, however, also take place when students or trainees are practicing.

Among other things, verbal as well as non-verbal reactions of students or trainees, test results (at the end of a course), and exercises made, all may be reasons for instructors to reflect on their lessons. Because of a lack of time, incapability, etc., these reflections rarely lead to lesson changes. If necessary, mostly changes take place during the lesson itself.

During the analysis of the log-book notes as a part of the research, it was striking that many instructors reflect positively on attitudes and personality aspects of students or trainees that are connected with learning processes and learning results. This is somewhat contrary to complaints about students' or trainees' motivation and previous training. The log-book notes made clear that it is not fair to attribute these complaints to students or trainees, but that they are due to external circumstances (e.g. not being prepared on a visit to a practical training centre, doing practices which are hardly connected with their field of study, etc.). Many of these and other external circumstances also appear to be sources of instructors' negative reflections. In general it can be concluded that students or trainees like practical lessons (cf. Kingma, 1986).

Issues regarding practical training

a. Practical lessons and learning areas

The agricultural skills to learn in the training centres vary from relatively simple actions (manual skills) to actions of a more complex nature (so-called entrepeneur skills referring to organizing, judging and planning). Generally, the possession of knowledge and insights regarding certain techniques, materials, parts, tools, machines, implements, animals and plants is a prerequisite for skill learning. To a more or less extent the application of knowledge and insights is stressed. Both of them determine the quality of a practical action. Knowledge and insights also result from skill learning or, by way of that, gain more sense for students or trainees.

Skill learning also includes social qualities (e.g. co-operation, patience, and tolerance) and intellectual qualities regarding organizing, judging and planning. More specific intellectual qualities (e.g. anticipation, discrimination, and evaluation) particularly take place during practical lessons, which encourage students or trainees to learn by discovery or problem solving.

In summary, practical lessons activate several learning areas

which are interrelated and overlap. Figure 8 tries to visualize this complex relationship.

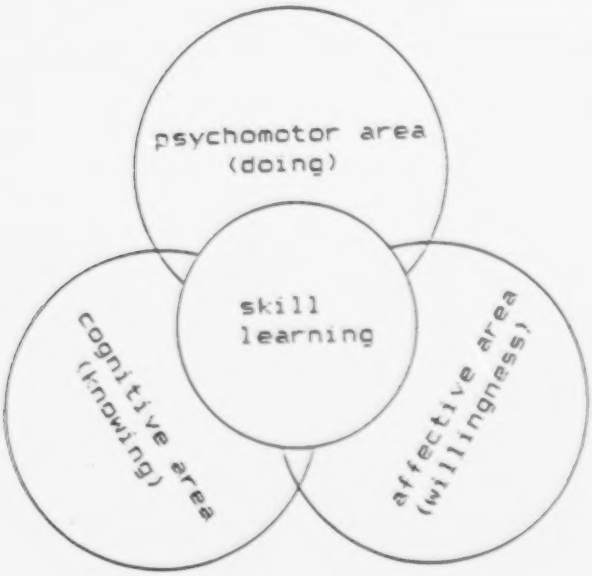


Figure 8: Areas of skill learning

As to the (implicit) lesson goals, it is possible to make a distinction in the psychomotor area between ability (being able to do what is necessary for a certain activity), proficiency (being able to do something after having practiced intensively), and mastery (as a higher degree of being able to do something). Which of these three is emphasized largely depends on lesson goals and contents. Furthermore, it is possible to make a similar distinction for the other two learning areas.

b. Lesson contents or subjects

Most of the instructors deliberately bring a sequence in the theoretical as well as the practical phase of their lessons. Between both phases there often exist a great consistency. Generally, the sequences depend on:

- the nature of the actions, or the working order which is more or less fixed;
- the reality in which the same sequence is employed (e.g. with ploughing);
- the machinery used (e.g. when treating a milk pipe).

Other considerations to bring sequences into lesson contents or subjects refer to the safety of man and animal.

Many instructors relatively pay much attention to the theoretical phase. However, especially for students or trainees with no or just a little practical experience, it is often difficult to link the transmitted knowledge with the practices to be executed. A well-considered dosage of theory and a better integration of theory and practice should be an important point of attention.

Figure 9 illustrates what is meant by this. The illustration, ideally, takes full account of the motivation, concentration, interest, and previous training of students or trainees.

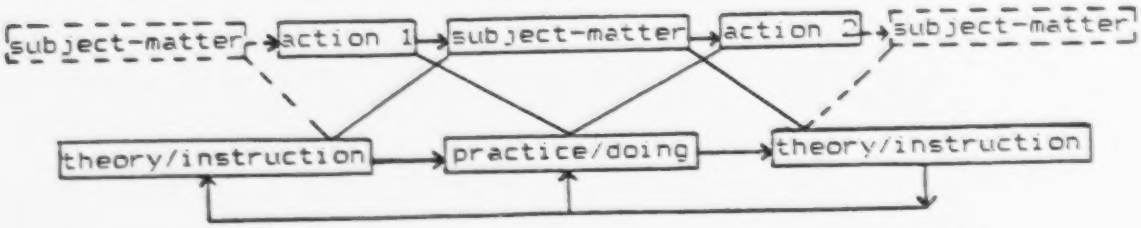


Figure 9: Example for the dosage and alternation of theory and practice

c. Structure and organization of practical lessons

Highly structured as well as unstructured lessons have been observed. Lessons of the first nature characterize themselves by the planning of all actions to be executed, and the predictability of the environment. During highly structured lessons in many cases instructional leaflets are used. These lessons are relatively simple to organize: the organization can be planned unequivocally, without anticipating on possible disturbances by environmental influences, including students or trainees, during the execution of lessons. This is an advantage, but highly structured lessons have also disadvantages: there is a possibility that students or trainees do not experience the benefits of practicing, and that their needs to learn a certain skill will not be met. These aspects are stressed in (relatively) unstructured lessons, e.g. by discovery-learning and challenging students or trainees to solve practical problems. Moreover, lessons of this nature cannot be planned completely. It is not possible - and not desirable too - to predict all the environmental influences.

The instructor's training style is linked with the extent of lesson structuring. Highly structured lessons lead to a directive style with the emphasis on subject-matter, while during unstructured lessons the training style is of an interacting nature with the emphasis on contributions of students or trainees.

d. Some didactical principles of frequent occurence

The professionalism of a teacher or instructor largely depends on the use of didactical principles. In a way they constitute the depth of one's action structure and, in general, they may be compared with didactical considerations. Some of these considerations or principles used by instructors are:

- giving examples, tips or hints taken from the real practice. Among other things, this principle clarifies abstractions and increases students' or trainees' imaginative faculties. Moreover, this principle is of a special importance to instructors

whose lessons include safety aspects and the care of animals;
- let students or trainees do what has been showed or demonstrated. Trying to match showed skills is, as instructors say, a challenge to students or trainees and often leads to quick and satisfying results;
- assisting only when students or trainees do not succeed and allowing them to learn from their own mistakes. Generally, instructors who handle this principle do not want to give trainees the idea that they are incapable or need immediate assistance;
- demonstrating or showing frequently made mistakes beforehand. According to many instructors this is a time-saving principle;
- repeating the same practice many times. This principle enables students or trainees to do something well.

Finally, didactical principles are linked with personal instruction qualities. They also depend on the objectives and the subject of a lesson.

CONCLUSIONS AND SUGGESTIONS FOR DIDACTICAL IN-SERVICE TRAINING

The interpretation of instructors' reflections has led to the following conclusions:
- many of the instructors'subjective theories or reflections on teaching and learning are of a concrete and intuitive nature. They lack the ability to use general theories of teaching and learning. Most of the instructors do not think in terms of didactical categories, and they often act according to 'recipes' adopted from colleagues or others;
- inadequate teaching does not need to be the result of acting according to 'recipes'. On the contrary, although it is true that insufficiently reflecting on these 'recipes' sooner leads to not intended teaching results. Above all, the latter is caused by a lack of acting-alternatives and the absence of opportunities to experiment with these alternatives in the educational practice;
- teaching takes place under limiting conditions, particularly caused by uncertainties with regard to students' or trainees' previous training and agricultural backgrounds. Partly because of this reason instructors' actions are based on standardized programmes made up by own experiences;
- didactical capabilities particularly find expression during the execution of practical lessons. Flexibility, the possession of improvising teaching skills, and being qualified in a field of specialization, all of these appear to be important didactical qualities of instructors.
- systematic reflection should play a more important part in the instructor's didactical professionalism. Reflection enables one to clarify one's actions and, by doing so, to give more sense to this actions.

These and other, not mentioned conclusions resulted in a didactical in-service training programme, which enables instructors to discover and to improve their possibilities with taking full

account of limiting factors from the task environment. By means of a theoretical frame of reference, the programme has to encourage instructors to reflect for themselves on their own 'recipes' and teaching routines, and to judge these by their adequacy or inadequacy Figure 10 summarizes the design and starting-points of the in-service training programme.

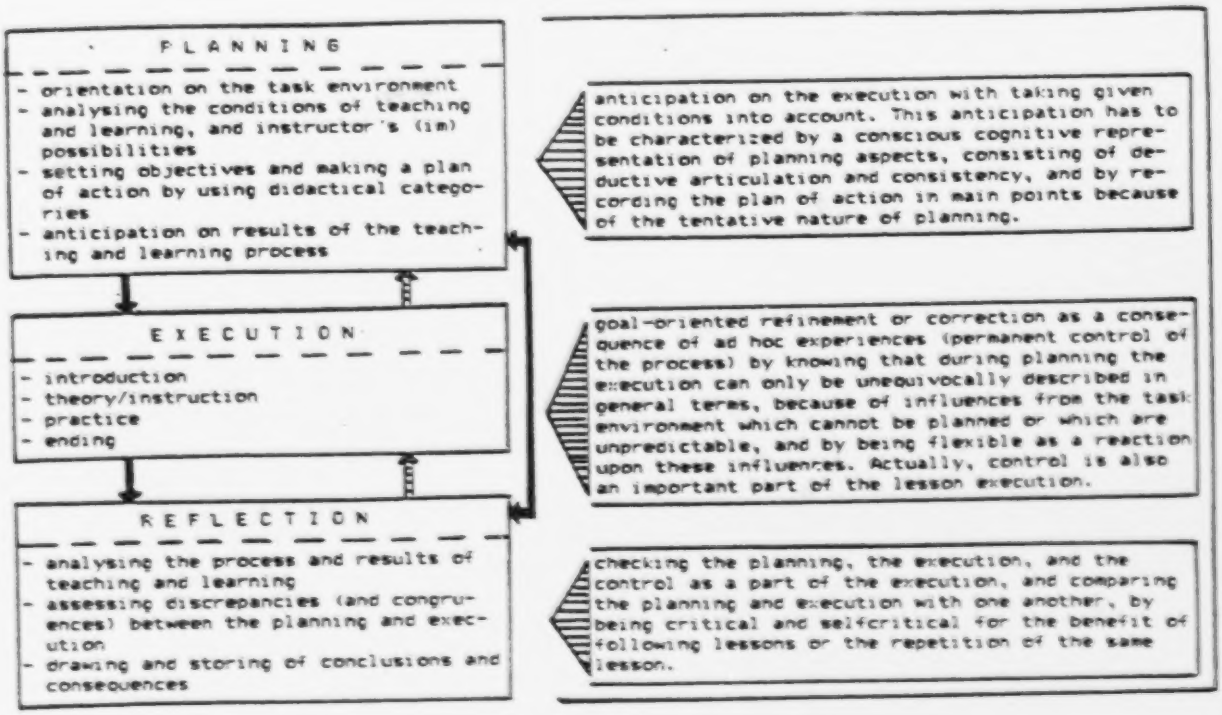

PLANNING
- orientation on the task environment
- analysing the conditions of teaching and learning, and instructor's (im) possibilities
- setting objectives and making a plan of action by using didactical categories
- anticipation on results of the teaching and learning process
EXECUTION
- introduction
- theory/instruction
- practice
- ending
REFLECTION
- analysing the process and results of teaching and learning
- assessing discrepancies (and congruences) between the planning and execution
- drawing and storing of conclusions and consequences
anticipation on the execution with taking given conditions into account. This anticipation has to be characterized by a conscious cognitive representation of planning aspects, consisting of deductive articulation and consistency, and by recording the plan of action in main points because of the tentative nature of planning.
goal-oriented refinement or correction as a consequence of ad hoc experiences (permanent control of the process) by knowing that during planning the execution can only be unequivocally described in general terms, because of influences from the task environment which cannot be planned or which are unpredictable, and by being flexible as a reaction upon these influences. Actually, control is also an important part of the lesson execution.
checking the planning, the execution, and the control as a part of the execution, and comparing the planning and execution with one another, by being critical and selfcritical for the benefit of following lessons or the repetition of the same lesson.

Figure 10: Framework of the didactical in-service training programme based on teaching as an action unit

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